

CLAIMS

1. A system for detecting a load of clothes in an automatic laundry machine of the type which comprises: a tub (2), a basket (3) mounted in the interior of the tub (2) and which is dimensioned to receive a load of clothes: and an electric motor (10) which selectively rotatively drives the basket (3) in an operation of the machine, characterized in that it comprises a voltage sensor (30) to detect the voltage supplied to the electric motor (10); a rotation sensor (40) to detect the rotation of the electric motor (10); and a control unit (20) operatively associated with a timer (21), with the voltage sensor (30), and with the rotation sensor (40), and which is supplied, in a presetting step of the machine, with data representative of the medium torque M_{mot} of the electric motor (10) in different voltage ranges, and with data representative of the acceleration and deceleration reference times (T_{a1} , T_{d1}) of the electric motor (10), with the basket (3) in the unloaded condition, between two distinct and predetermined rotation values of the electric motor (10), in order to calculate the reference moment of inertia (J_v) of the basket in the unloaded condition, said control unit (20) receiving, selectively, at the beginning of each operation of the machine, data representative of the acceleration and deceleration operation times (T_{a2} , T_{d2}) of the electric motor (10), with the basket containing a load of clothes, between said rotation values of the electric motor (10), and processing the data representative of the medium torque M_{mot} of the electric motor (10), in the voltage range detected by the voltage sensor (30), and the data of the acceleration and deceleration reference times (T_{a1} , T_{d1}) and of the acceleration and

deceleration operation times (T_{a2} , T_{d2}), in order to determine the moment of inertia (J_c) of the basket (3) with the load of clothes and the difference of said moments of inertia (J_c and J_v) of the basket (3), and to produce a signal representative of the mass of the load of clothes.

2. The system according to claim 1, characterized in that the rotation sensor (40) is a tachometer operatively associated with the electric motor (10).

10 3. The system according to claim 1, characterized in that the control unit (20) calculates the reference moment of inertia (J_v) of the basket (3) in the unloaded condition, by means of successive calculations of the moments of inertia of the basket (3) from the data of the acceleration reference time (T_{a1}) and, subsequently, of the deceleration reference time (T_{d1}), establishing, in the first calculation, zero value for the resistive moment of the basket (3) produced by the friction between the relatively moving parts upon the rotation of the basket (3).

4. The system according to claim 3, characterized in that the calculation of the reference inertia moment (J_v) is effected by the control unit (20) utilizing the formulas:

$$\begin{aligned} 25 \quad (1) \quad T_{a1} &= \frac{2\pi \Delta r_{pm}}{60} \times \frac{J_v}{M_{mot} - M_{res}} \\ (2) \quad T_{d1} &= \frac{2\pi \Delta r_{pm}}{60} \times \frac{J_v}{M_{res}} \end{aligned}$$

5. The system according to any of the claims 1-4, characterized in that it further comprises, operatively associated with the control unit (20), an inlet valve means (60), to control the supply of the washing liquid to the machine, and a level meter (50) provided to detect determined levels of the washing liquid within the basket (3), said control unit (20)

- associating the signal representative of the mass of the load of clothes with an adequate level of the washing liquid in the basket (3), so as to produce a blocking signal to the inlet valve means (60),
5 interrupting the supply of the washing liquid to the machine when the level meter (50) detects said adequate level of washing liquid has been reached.
6. The system according to claim 5, characterized in that the inlet valve means (60) is an electrovalve
10 that is normally closed.
7. The system according to claim 6, characterized in that the level meter (50) is a pressure switch mounted to the tub (2).
8. The system according to claim 1, characterized in
15 that the control unit (20) is programmed to command the energization of the electric motor (10), accelerating it until reaching a maximum rotation that is higher than said distinct and predetermined rotation values, and then de-energizing the electric
20 motor (10) so that its rotation decelerates to a value that is lower than said distinct and predetermined values, both in the presetting step and in the beginning of each operation of the machine.
9. The system according to claim 8, characterized in
25 that said maximum rotation is of about 1300 rpm.
10. The system according to claim 9, characterized in that said distinct and predetermined rotation values maintain a mutual difference of about 460 rpm.
11. A process for detecting a load of clothes in an
30 automatic laundry machine of the type which comprises a tub (2); a basket (3) mounted in the interior of the tub (2) and dimensioned to receive a load of clothes; and an electric motor (10) which drives, selectively and rotatively, the basket (3) in an operation of the
35 machine, which process is characterized in that it

comprises the steps of:

- rotatively driving the electric motor (10) with the basket (3) in the unloaded condition, maintaining its energization until a maximum rotation has been reached, the electric motor (10) being then de-energized and decelerated to a reduced rotation value, as a function of the friction between the movable parts;
- detecting the rotation of the electric motor (10) in two distinct and predetermined rotation values, which are lower than the maximum rotation value, both in the acceleration phase and the deceleration phase;
- measuring the acceleration and deceleration reference times (T_{a1} and T_{d1}) of the electric motor (10) between said distinct and predetermined rotation values;
- calculating a reference moment of inertia (J_v) of the basket (3) in the unloaded condition, in a step of presetting the machine to a posterior operation, by processing the data representative of the acceleration and deceleration reference times (T_{a1} and T_{d1}) and of the known medium torque (M_{mot}) of the electric motor (10) for the determined voltage;
- before each washing operation of the machine, measuring the voltage supplied to the electric motor (10) and rotatively driving the electric motor (10) with the basket (3) containing a load of clothes, maintaining the energization of the electric motor (10) until said maximum rotation has been reached, and de-energizing and decelerating the electric motor (10) by action of the friction between the movable parts;
- detecting the rotation of said electric motor (10) in the two distinct and predetermined rotation values in the acceleration and deceleration phases with the load of clothes;

- measuring the acceleration and deceleration operation times (T_{a2} and T_{d2}) of the electric motor (10) between said distinct and predetermined rotation values;
- 5 - calculating the moment of inertia (J_c) of the basket with the load of clothes, by processing the data representative of the acceleration and deceleration operation times (T_{a2} , T_{d2}) and of the medium torque (M_{mot}) of the electric motor (10) for the detected
10 supply voltage;
- calculating the difference between said moments of inertia (J_c , J_v) of the basket (3) and producing a signal representative of the mass of the load of clothes.
- 15 12. The process according to claim 11, characterized in that the calculation of the reference moment of inertia (J_v) of the basket (3) in the unloaded condition is effected through successive calculations of the moments of inertia of the basket (3) from the
20 data of the acceleration reference time (T_{a1}) and then of the deceleration reference time (T_{d1}), giving, in the first calculation, zero value to the resistive moment (M_{res}) of the basket (3) produced by the friction between the relatively moving parts upon the
25 rotation of the basket (3).
- 13. The process according to claim 12, characterized in that the calculation of the reference moment of inertia (J_v) is effected according to the formulas:
- (1) $T_{a1} = \frac{2\pi \Delta rpm}{60} \times \frac{J_v}{M_{mot} - M_{res}}$
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- (2) $T_{d1} = \frac{2\pi \Delta rpm}{60} \times \frac{J_v}{M_{res}}$
- 14. The process according to claim 13, characterized in that the processing of the data used for
35 calculating both the reference moment of inertia (J_v)

and the moment of inertia (J_c) and for producing the signal representative of the load of clothes is effected by a control unit (20) operatively associated with a voltage sensor (30), with a timer (21), and
5 with a rotation sensor (40) coupled to the electric motor (10).

15. The process according to any of the claims 11-14, characterized in that it comprises the steps of associating the signal representative of the load of
10 clothes with a determined level of the washing liquid in the basket (3), and producing a blocking signal, for interrupting the supply of the washing liquid to the machine when the determined level of the washing liquid has been reached.

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